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of this Anodonta extends over a vast area, embracing thousands of square miles of which as yet but little is known.

Every item bearing upon the geographical distribution herein referred to, and more elaborately discussed in my recent paper,[1] indicates the mountain lakes as the sources from whence the species have migrated, and point also to their descent from northerly regions as well as from higher altitudes, and also contribute additional testimony as to the antiquity of these widely-spread though inferior forms of animal life.

Admitting the presence of *Physa humerosa* within the drainage of the Pecos, to which we find it accredited, and considering the new locality for *Anodonta californiensis* which Mr. James has given us, and the fact that the *humerosa* form of Physa seems to be (geographically within the southerly portion of our West American or occidental Anodon province) a pretty constant companion with said fresh-water mussel, we are encouraged to hope that we may find this aspect of the general West American form of Anodon represented within such drainage areas as contain or are inhabited by the Physa.

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REVIEW OF REPORT C_4, SECOND GEOLOGICAL SURVEY OF PENNSYLVANIA.

BY DR. PERSIFOR FRAZER.[2]

THIS new volume of the publications of the Pennsylvania Survey deserves much more than a passing notice, from the eminence of its editor and the number and nature of the criticisms which it challenges.

As to the latter they should commence with the title page, where, as will sufficiently appear further on, Mr. Hall would certainly repudiate the claim of having added materially to the structural geology of Chester county; indeed he has done so both personally to the writer and in his pages (54 to 64) of this volume. It will be advisable to consider his part of the volume first, but before doing so the writer wishes to protest against the heading of page 1, which should have been altered to conform to the title page. · The three hundred and ninety-four pages which follow this heading are not in any sense a report of Persifor Frazer. That person is disposed rather to regard them as constituting a scrap-book of some new, some true, some old, and some other things originating from many persons, living and dead. One characteristic feature of the book is the way in which one of its parts stultifies another. After this perhaps comes the incongruous divisions of the subject (divisions as incommensurable as inches, pounds and years), which are woven together by the eminent editor so that the bewildered reader knows not whether he is reading Hartman, Rogers, Lesley or Hall, and only becomes aware after half the book is perused, that whoever else he may be reading it is not Frazer.

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[1] On the History and Distribution of the Fresh-water Mussels, &c., &c. Proc. Cal. Acad., Nov. 20, 1882.

[2] C_4. Second Geological Survey of Pennsylvania. "The Geology of Chester County after the Surveys of H. D. Rogers, Persifor Frazer and Charles E. Hall. Edited by J. P. Lesley. Harrisburg, 1883."

It is well known to most American and many European geologists that Rogers (and many other geologists of his time) was clearly mistaken as to the constitution of a large series of rocks which he called the "talc-mica" series, the error being that these rocks contained no talc whatever, the mineral that was taken for talc being a hydrous mica of the Damourite group. The term "talc-mica" had almost disappeared from the papers of those geologists who had kept up their lithology before the Second Geological Survey was commenced, and the directors of most of the State geological surveys (must we except that of Pennsylvania?) are aware how much the labors of various assistants of the latter survey have done to establish permanently, on a sound basis, the true relationships of those schists.

Yet the old name, "talc-mica" region, is retained as if it actually defined something, and not only in the quotations from Rogers, but in the numerous editorial comments. The magnesia which these schists are supposed to contain (contrary to the results of repeated analyses by Dr. T. S. Hunt, Dr. Genth, Mr. McCreath, the writer and many others) is made the basis of an hypothetical speculation as to the superposition of the South Valley Hill series on the limestone.[1]

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[1] See p. 103, where also notice an argument in favor of the magnesian character of the schists "because they have always been known as the talc slate belt." The term talc-mica occurs continually throughout the volume wherever Professor Lesley's work appears, although it is universally conceded by geologists that the name was given under a misapprehension of the true nature of the hydromica schists which in reality contain no talc at all. Most reports and treatises on these rocks in the last ten years have recognized these facts, and none more so than the Second Geo-

Mr. Hall's "Notes," *i. e.*, pp. 54 to 64, are brought under a sub-heading of Rogers called the "Southern Gneiss." For some reason neither the colored map (presumably that on which the error of the county map-maker, in continuing a water course a very short distance too far along the Nottingham township border, was *not* "culpably copied")[1] nor the reduced page map is placed opposite to Mr. Hall's contribution, though he speaks in the first sentence of "the accompanying map," and he informed the present writer that this text was simply intended to explain that map and not to propound or support any theory whatever. This is plain in his pages, which are merely jottings from his field notebook. In his preliminary remarks he defines the areas of his map, which he has covered with certain symbols. All these general observations agree perfectly with those made by Dr. Frazer several years before Mr. Hall went to Chester county, printed in the descriptions of London Grove, New Garden and Kennett townships. Sufficient reasons are given in the latter places for believing that the same limestone underlies parts of these townships though "not visible at the surface." The rest of the "Notes" are simply localities where Mr. Hall has observed, "A. Laurentian syenite," "B. Sandstone and quartzite," "C. Limestone," "D. Hydromica schists," "E. Mica schists," and F. Serpentine." As to the latter he was "not able to convince himself of the true character of the deposit." While of E (mica schists) he frankly says: "As to structure I found it impossible to reconcile the stratigraphy of this part of Chester county with that of Delaware county by means of the numerous outcrops of rocks along nearly all the roads which cross the schist belt (if it be a belt), nor by means of

logical Survey. Thus Report C for 1874 has a description and analysis of these rocks (pp. 104 and 105) which seems to be conclusive as to their character. It concludes, "both the analyses tend to support the view that the mineral or minerals which give the unctuous feel and pearly lustre to the schists belong to the Hisingerite group of the Margarophyllite section of hydrous silicates (Dana's system)."

What makes this nomenclature the more unfortunate is, that there are, in certain localities, associated partly with the hydromicas and chlorites, well defined and veritable talc rocks which are thus confounded with the larger zone of which they form an important but very small geographical part.

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[1] See p. 10. The implication here of carelessness on the part of Dr. Frazer is unfounded, as is also the statement that Northeast creek is made to head in Maryland and flow north into the Octoraro creek. The appearance of the branches of the Maryland stream is inconsistent with this statement.

the larger streams" (p. 60). So much for the text of Mr. Hall. There is not the slightest suggestion of a theory of any kind. It is in character like the record of facts contained in the "Township Geology," and it is nothing else; nor is there one fact added which is new, unless it be the "laurentian syenite" which in division "A" is called "syenitic gneiss," "syenitic rock" and "syenitic or granitoid rock." These exposures, though not indicated on Dr. Frazer's map, are described in the text of his Mémoire on this region printed in France and sent to the Geological Survey of Penna., in June, 1882, as well as in the township geology of the present volume. The reduced map of Mr. Hall has even less claim to originality than the "Notes," because the colored map of Chester county, in which exists the "culpably copied" error of Northeast creek, was printed in 1880–81. This map contains all the data which are found on Mr. Hall's map (except the areas of "syenite") and a great deal more beside. It is with the greatest respect for Mr. Hall, for his ability and for his work that the writer here says that the purpose that can be served by printing that part of the map opposite p. 6, which represents Chester county (a small part on the left), is very obscure. Of this map Professor Lesley says, "nothing is laid down which does not appear above the soil" (p. 33). However this may be (and it is not admitted), it is nevertheless true that many things appear above the soil which are not on Mr. Hall's map. The same authority (p. 37) states: "We owe to Mr. Hall's close and intelligent observation the collection of a large amount of satisfactory evidence for the general horizontality or low-dip angle of most of the rocks of this region [the "southern gneiss region"], whereas it had been taken for granted that a general steepness of dip prevailed."

Whatever may be Mr. Hall's contributions towards this knowledge the writer does not know, nor does he desire in the remotest degree to disparage them, yet the above editorial comment is most unjust to the earlier worker, who already had observed this fact in his study of Lancaster county, and subsequently made it a most important factor in the explanation of the intricate structure of Chester county near the Delaware State border. [See Mémoire sur la geologie de la Pennsylvanie. Lille, 1882. The horizon of the South Valley Hill rocks, Proc. Am. Phil. Soc., Dec. 15, 1882, pp. 322, 326, 328,[1] and many other places of the report under review, &c.]

The first chapter of the book under review (by the chief geologist, Professor J. P. Lesley) consists of thirty-two pages, of which the first six pages contain a general statistical account of the history, population, roads, &c., of Chester county. Here a division of the county into five regions is based upon Rogers's old system, and besides its very artificial character, contains faults which Rogers himself would probably not repeat now were he to re-write it.

These divisions are, 1st. "The southern region of Philadelphia gneiss," which neither Messrs. Hall nor Frazer have been able to adopt. This region is not defined by Professor Lesley, but judging from the water courses mentioned in connection with it, it includes much of the chlorite and hydromica schists.

Chapter II is the "Geological Description," and commences by alluding to the two maps of Chester county, one by Frazer, printed in 1880, and the other by Hall in 1882. The chief geologist here says, "Professor Frazer is dissatisfied with several details of the map as published, and especially with the manner of representing the hydromica schists south of the Chester valley." After repeating these objections in the Assistant's own words, Professor Lesley states the reasons for printing the map, with a division which Frazer had after two years' work failed to justify, to be that "had the pink color * * been given to the schist area * * it would have *confused the geology of south-eastern Chester*, Delaware, Montgomery and Berks." If the first of the list refers to Frazer's own interpretation of the geology, it is an error; and if it refers to the theories of Mr. Hall the pertinent question arises whether it is better that the map of a geologist should be allowed to agree with his own views and previously printed work, or altered in an important particular, in order that it might agree with the views of others? Even Mr. Hall will not take the responsibility of this change, for he says (p. 54), "The hydromica schists (of the South Valley Hill belt) spread through the south-west part of Chester county with a *somewhat indefinite line*," &c., &c.

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[1] Speaking of feldspathic gneiss, which may be Potsdam, Frazer says in the last-quoted passage, "The dips in this area, in fact all the measures, are in unusual and very varying directions, and the angle with the horizontal plane usually low." These notes were made in 1879 or before Mr. Hall had expressed any opinion about the "southern gneiss region."

It may not be entirely inapposite here to advert to the singular discrepancy between the principles and practice of one who but a little while ago plead so eloquently in the "Iron Manufacturer's Guide" and in "Coal and its Topography" for the rights of the subordinate geologist.[1]

In a great mass of description, taken bodily out of Professor Rogers's work, there is found even a description of a few lines given to Wood's chrome mine *in Lancaster county, made in 1853!* notwithstanding that this mine is treated quite fully as it exists today in Vol. C_3 on pp. 177, 192, 193, 194, 195 and 196, and specimens from it are recorded on pp. 286 and 287 of that volume.

A striking instance of the manner in which this volume is edited is exhibited on the page plate opposite p. 98, called "Three hypotheses of structure."

The upper (Fig. 1) is called "Theory of H. D. Rogers," the lower (or Fig. 3) is entitled "Theory of C. E. Hall," while the middle (Fig. 2) designed to embody the fault along the South Valley hill, is unmarked by the name of an author, though this is the view defended by Frazer, and letters have been received by the latter from many eminent geologists of the United States and Canada expressing their accord with it. The pre-Potsdam age of the South Valley Hill rocks was also strongly endorsed by Professors Gosselet and Barrois, who examined with great minuteness the theories of the geology of this region put forth in the Mémoire before alluded to.

A great deal of what has been objected to above may be conceded to the editor of C_4 because of the latter's own difference of opinion from that of Dr. Frazer, but this is not the case with all.

[1] In the preface to the "Iron Manufacturer's Guide," 1859, p. 9, Professor Lesley says: "One must take the names as and where they are published, whatever may be the unknown wrong done to the real workers and thinkers." Again, p. 668, in referring to a mistake made by Professor H. D. Rogers, he says: "His work is full of such blunders, the discredit of which would have been saved him had he given proper credit to his various authorities whenever it was due, or rather republished their own reports in their own language, as he should have done."

In the "Manual of Coal and its Topography" (a charming little book now unfortunately out of print) Professor Lesley says (p. 210): "No primary report should receive the touch of any hand but that of the first observer. Let it come fresh and clean before the examination of the world, and stand or fall (with its author) by its own merits."

On p. 104 Professor Lesley speaks of Dr. Hartman's geological map of Chester county as defining the S. E. limit of the "Talc-mica belt." On p. 105 he says, "*I* have defined such a border;" which language would imply that the supposed border between the hydro-mica and chloritic areas, which is given in the colored map, emanated from Dr. Hartman or Professor Lesley. The writer has never seen Dr. Hartman's map, but the chance of his boundary agreeing exactly with Dr. Frazer's in such a country is not one in millions. The boundary now printed on the colored map is the identical boundary traced provisionally by Dr. Frazer on his first manuscript map, and afterwards so completely disproved by its author that it was abandoned.

It will also strike the average reader as in questionable taste to refer (p. 106) to the supposed opinion of the late Professor John F. Frazer, which he entertained, if at all seriously, simply as an hypothesis which he never had the opportunity to decide; and to force Dr. Frazer into an apparent opposition to his father, by the misleading words that the latter "assisted Professor Rogers in 1853 and was personally very familiar with Chester county." Professor John F. Frazer did *not* study the geology of Chester county under Rogers nor subsequently, and he would have been the last to present the results of desultory observations during his visits for recreation as a definite theory founded on systematic work.

The third division is the "Downingtown valley," and the fourth the "Northern gneiss and Potsdam sandstone region." In this latter Professor Lesley follows Rogers, alluding to the "*greenstone trap*" traversing the shale, the fact being that if there be any greenstone in this region it has been entirely overlooked by subsequent observers, its quantity is very inconsiderable, and its importance entirely subordinate to that of the dolerites and syenites which make up almost, if not quite all, the igneous masses of the county. The fifth division is the Schuylkill region of Mesozoic Triassic (new red) sandstone and shale. To this is appended a short summary of the iron works, past and present, of the county.

A word is due in explanation of the character of Frazer's work (*i. e.*, Township Geology) which appears in C_4. Seven months of 1879 and five months of 1880 were spent by him in the collection of facts for the proper report on the geology of this most difficult region. It is probable that two more full seasons would have been spent in Chester and the adjoining parts of Delaware and Montgomery counties before he would have felt ready to write their geology. Owing to the termination of his connection with the Second Geological Survey, and the consequent imperative demands upon his time of other occupations, such notes as he had made, which would otherwise have been ready in the early summer of 1881, were finished and sent to the Geological Survey in Feb. 1882, with the request that he be allowed to correct the proof; yet the first impressions seen by him were the stereotype or plate proofs of pp. 145 to 354 (without the illustrations). These were not received till the present year.

In the meantime Mr. Hall's Report C_6 had appeared,[1] and Professor Lesley had stated in the introduction that we could now "accept the Palæozoic age of the Philadelphia rocks with a moderately reserved confidence." This led to a paper on the horizon of the South Valley Hill rocks, before referred to, which was honored by favorable comment from a number of distinguished geologists, among whom was Professor Lesley himself.[2]

It is very much to be regretted that the generally valuable and justly admired volumes of the Second Geological Survey of Pennsylvania should be accompanied by a book of this kind. Not only can the text serve no useful purpose, except to indicate some dry facts obscured by a great deal of very unsound reasoning, but it cannot conceal by any amount of rhetoric the palpable fact that it is a make-shift, consisting of heterogeneous materials in juxtaposition but not joined together. The colored map, which represents a great deal of hard work, is defaced by a belt which has no existence in fact, as the writer well knows, for he sketched it as a working hypothesis and completely refuted it afterwards.

It is hardly unfair to say that if there were a museum for the preservation of teratological specimens of geological literature, this volume C_4 would be more fitly placed there than on the shelves with the best of its alphabetical sisters of the Second Geological Survey of Pennsylvania.

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[1] October 24, 1882.

[2] Professor Lesley said in his remarks on the conclusion of the reading of the paper, that the subject therein treated had been constantly in his mind for many months, and he had come to the conclusion that the views just presented were the only safe ones to hold.